•• REMARKS/ARGUMENTS ••

The Official Action of October 4, 2005 has been thoroughly studied. Accordingly, the following remarks are believed to be sufficient to place the application into condition for allowance.

By the present amendment independent claim 1 has been changed to include the limitations of dependent claims 12 and 13 and to specifically recite a helical electrodeionization device.

Dependent claims 12 and 13 have accordingly been canceled and claims 14-17 have been amended to depend on claim 1.

In addition, independent claim 1 has been changed to recite at least two integrated support frames in order to provide support for the interphase aisle structure which is provided between spaced apart adjacent ones of the support frames as shown in Fig. 2.

New claim 18 has been added which recites that frame is arranged to provide spatial and structural support to the anion and cation membranes which define the diluent flow channel.

Other changes to the claims correct matters of grammar and form.

Entry of the changes to the claims is respectfully requested.

Claims 1-11 and 14-18 are pending in this application.

On page 2 of the Office Action the Examiner rejected claims 2-5 under 35 U.S.C. §112, second paragraph. Under this rejection the Examiner noted antecedent basis problems for the terms

"the longitudinal direction" and the axial direction" in claim 2 and the term "the longitudinal bars" in claim 3 and the term "the latitudinal bars" in claim 4.

The claims have been amended herein to correct the antecedent basis problems.

Also under this rejection the Examiner stated that it was not apparent from the language of claim 5 how the array of bars defines the adjacent membranes.

In response to this rejection, claim 5 has been changed to recite that each of said integrated support frames comprise an array of bars that are provided on the adjacent anion exchange membrane and cation exchange membrane. This structure is shown in Fig. 2 in which three support frames are depicted as being spaced apart from one another on a membrane.

It is believed that the changes presented herein to the claims addresses and overcomes the outstanding rejection of claims 2-5 under 35 U.S.C. §112, second paragraph.

Claims 1, 2, 5, 6 and 11-17 stand rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 6,190,528 to Li et al. in view of U.S. Patent No. 4,062,756 to Jha et al. or U.S. Patent No. 6,344,122 to Deguchi et al.

Claims 3 and 4 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Li et al. in view of Jha et al. or Deguchi et al. and further in view of U.S. Patent No. 4,437,967 to Sanchez et al.

Claims 7-10 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Li et al. in view of Jha et al. or Deguchi et al. and further in view of U.S. Patent No. 3,985,636 to Schneider.

For the reasons set forth below, it is submitted that all of the pending claims are allowable over the prior art of record and therefore, the each of the outstanding prior art rejections should properly be withdrawn.

Favorable reconsideration by the Examiner is earnestly requested.

The Examiner has relied upon Li et al. as disclosing a helical electrodeionization apparatus that includes:

> ...an anion exchange membrane, a cation exchange membrane, a first electrode, a plurality of membrane bags formed by the anion exchange membrane and the cation exchange membrane and a second electrode.

The Examiner notes that the membrane bag has a concentrate flow channel and a dilute flow is located adjacent the membrane bag.

The Examiner states that:

> Claim 1 differs from the apparatus of Li et al by reciting a frame having an array of bars which is arranged to support the dilute flow channel.

The Examiner has accordingly relied upon Jha et al. as being directed to "a liquid flow distribution screen particularly suited as a membrane support and spacer in electrodialysis apparatus."

With respect to Jha et al. the Examiner notes:

> As shown in figure 1 bar-shaped elements 10 extent in one direction which may be considered longitudinal while bar-shaped elements 14 extend in a transverse direction which may be considered latitudinal.

The Examiner has relied upon Deguchi et al as being directed to a deionization apparatus that:

> As shown in figure 1, ...includes a partition member 21 which is positioned between an anion exchange membrane 24 and a cation exchange membrane 25.

With respect to Deguchi et al. the Examiner notes that an ion exchange material 25 fills the space, and states that "[t]he partition member corresponds to applicant's claimed frame."

The Examiner further states that:

> As shown in figures 3 and 9 the partition can be made up of a series of parallel bar-shaped members. See column 4, lines 45-59.

On page 4 of the Office Action the Examiner states "The prior art of record is indicative of the level of skill in the art" and takes the position that:

> It would have been obvious...to have included a frame having an array of bars in the apparatus of Li et al as taught by Jha et al or Deguchi et al because the anion and cation membranes would have better support.

It is submitted that the present invention, as claimed, structurally distinguishes over each of Jha et al. and Deguchi et al.

Moreover, the present invention functionally distinguishes over each of Jha et al. and Deguchi et al. due to the structural differences.

It is known in the art that a dilute support frame can be arranged to support a dilute flow channel and allow dilute water to flow fluently therethrough.

However, a particular challenge associated with electrodeionization (EDI) devices is how to fill and refill the ion exchange resin in the dilute flow channels.

The present invention provides a support frame structure that produces spatial and structural support for the anion and cation membranes which defines a dilute flow channel which allows for easy filling and refilling of ion exchange resin after the membrane element is installed.

This is accomplished by providing support frames that are spaced apart so as to define an interphase aisle structures between adjacent pairs of the support frames, as illustratively depicted in Fig. 2.

Jha et al. teaches a flow distribution screen that includes a first set of strands 10 and a second set of strands 14. The second set of strands 12 includes segments 14 and segments 16. As disclosed, "segments 14 act to block flow, while segments 16 allow passage." The arrangement of segments 16 provides for fluid to flow in a desired flow pattern as illustrated in Figs. 1, 3 and 4. The strands 14 and 12 of Jha et al, form a continuous extending structure as shown without any spaced apart frame portions that define interphase aisle structures between adjacent pairs of frame elements.

Deguchi et al. teaches a frame 20 that contains various partition members that are configured to form or define cells. The partitions members have portions that are inclined obliquely relative to a longitudinal direction of the desalting compartment so that water flows obliquely between the cells as illustrated in Fig. 4. The cells and partition members extend between the sides of the frame 20 without any spaced apart portions that define interphase aisle structures between adjacent pairs of the partition members.

As can be seen, neither Jha et al. nor Deguchi et al. teach a support frame that includes frame elements that are spaced apart so as to define interphase aisle structures between adjacent pairs of frame elements.

Accordingly, neither Jha et al. nor Deguchi et al. provide a support frame in an electrodeionization apparatus that allows for easy filling and refilling of ion exchange resin after the membrane element is installed.

According to the principle of mass transfer, it is well known that ions tend to spontaneously transfer from a higher concentration gradient to a lower concentration gradient. Because of the selectivity of any ion exchange membrane, it is difficult to achieve 100% ion transfer. A phenomenon inevitably exists that a small quantity of ions in the concentration side transfers into the dilute side. In order to eliminate the undesirable transfer of ions which will consequently damage the product water quality, the pressure of the dilute chamber must be controlled to be higher than the concentrate chamber in any point in the whole operation process.

So a support frame also supports sticking and locking the ion exchange membranes which define the dilute chamber and prevents the membranes which define the dilute chamber from rupturing due to the pressure differences between the dilute chamber and concentration chamber.

Also in the electrodeionization process, the ion particles contained in the feed water transfer reversely towards the electrode under influence of the electric field (in addition to transferring from the dilute chamber to the concentrate chamber). Even though the support frame is nonconductive, as

the support frame allows dilute water to flow fluently therethrough, it will invariably increase electric resistance and a resulting decrease ion transfer efficiency in the dilute chamber.

According to the present invention, the integrated support frames are wound on or in the membranes of the EDI device with interphase aisle structures to limit the frame arrays and ensure that water flow is fluent.

In addition to ensuring fluent flow, the interphase aisle structures of the support frames of the present invention provide a decrease in the resultant electric resistance due to the nonconductive frame being as minimal as possible.

As noted above, neither Jha et al. nor Deguchi et al. teach support frames that include frame elements that are spaced apart so as to define interphase aisle structures between adjacent pairs of frame elements.

Accordingly, neither Jha et al. nor Deguchi et al. provide a support frame that ensure fluent flow and provide decrease in the resultant electric resistance due to the nonconductive frame being as minimal as possible.

The Examiner has relied upon Sanchez et al. as disclosing:

> ...a chamber which includes a frame 3 between two membranes 1 and 2. The frame includes parallel strips 23 which are in the shape of bars. The membranes rest against the faces of the strips and are kept in place without there being a significant risk of deformation (column 5, lines 18-21). Sanchez et al. discloses that the spacing can be about 2 to 3 mm for maximum efficiency (column 5, lines 23-24).

The Examiner takes the position that:

> Choice of spacing of bars in a frame provided in the apparatus of Li et al as suggested by Jha et al or Deguchi et al would have been a matter of routine optimization to control flow and efficiency as taught by Sanchez et al. The 3 mm spacing of Sanchez et al falls within the range recited in instant claim 3.

The Examiner's position and reliance upon Sanchez et al. overlooks the fact that Sanchez et al is directed to electrophorsis and electrophoretically fractionating solutions.

In contrast, Li et al. (and the present invention) is directed to electrodeionization.

It has not been established on the record that electrophorsis and electrodeionization are sufficiently related so that the 3 mm membrane spacing taught by Sanchez et al. is at all applicable to, let alone an optimization of the electrodeionization process of Li et al.

Under the court of appeals' holding in *In* re Wesslau:

> It is impermissible within the framework of Section 103 to pick and choose from any one reference only so much of it as will support a given position to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art. In re *Wesslau*, 147 USPQ 391 at 393 (CCPA 1965)

The Examiner has relied upon Schneider as disclosing an electrodialysis apparatus that has "rod shaped electrodes which have a circular cross section."

The Examiner notes that Schneider:

> ...teaches that the electrodes may take the form of tubes or bars and have any convenient cross-sectional configuration such as an oval or polygon (column 3, lines 55-60).

The Examiner takes the position that:

> It would have been obvious to have provided the bars in a frame in the apparatus of Li et al as suggested by Jha et al or Deguchi et al in a variety of cross section as taught by Schneider because bar-shaped components of an electrodialysis apparatus may usefully have any convenient cross-section.

The Examiner's reliance upon Schneider is misplaced, because the neither the support structures of Jha et al. or Deguchi et al. or of applicants' claimed invention are electrodes.

It certainly is not obvious to modify the support structures of Jha et al. or Deguchi et al. with the completely unrelated electrodes of Schneider. Such a proposed modification lacks the basic nexus that is required under 35 U.S.C. §103.

Based upon the above distinctions between the prior art relied upon by the Examiner and the present invention, and the overall teachings of prior art, properly considered as a whole, it is respectfully submitted that the Examiner cannot rely upon the prior art as required under 35 U.S.C. §103 to establish a *prima facie* case of obviousness of applicants' claimed invention.

It is, therefore, submitted that any reliance upon prior art would be improper inasmuch as the prior art does not remotely anticipate, teach, suggest or render obvious the present invention.

It is submitted that the claims, as now amended, and the discussion contained herein clearly show that the claimed invention is novel and neither anticipated nor obvious over the teachings of the prior art and the outstanding rejection of the claims should hence be withdrawn.

Therefore, reconsideration and withdrawal of the outstanding rejection of the claims and an early allowance of the claims is believed to be in order.

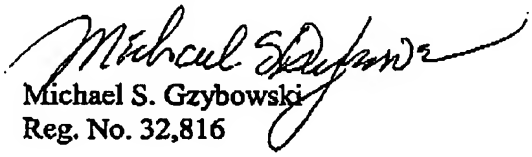
It is believed that the above represents a complete response to the Official Action and reconsideration is requested.

The prior art made of record on page 5 of the Office Action, but not relied upon by the Examiner has been noted.

If upon consideration of the above, the Examiner should feel that there remains outstanding issues in the present application that could be resolved, the Examiner is invited to contact applicants' patent counsel at the telephone number given below to discuss such issues.

To the extent necessary, a petition for an extension of time under 37 CFR §1.136 is hereby made. Please charge the fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account No. 12-2136 and please credit any excess fees to such deposit account.

Respectfully submitted,



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